
Volume 96
Number 4
2009

Annals
of the
Missouri
Botanical
Garden



A REVISION OF THE MALAGASY ENDEMIC *HELMIOPSIS*
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ABSTRACT

A taxonomic revision of the endemic Malagasy genus *Helmiopsis* H. Perrier (Malvaceae s.l.) is presented, based on material that has been collected since the last complete revision by Arènes. Nine species and one subspecies are recognized, of which one species (*H. polyandra* Appleg.) and one subspecies (*H. hily* Arènes subsp. *boinensis* Appleg.) are newly described from Madagascar. Arènes' infrageneric taxonomy is simplified; two sections (section *Glandulipetalae* Arènes and section *Helmiopsis*) are recognized. The section *Glandulipetalae* is typified by *H. pseudopopulus* (Baill.) Capuron ex Arènes, and *H. inversa* H. Perrier, the type species for the genus, is lectotypified. *Dombeya rigida* Baill. is excluded from *Helmiopsis*. Preliminary conservation assessments using IUCN criteria indicate that most taxa are of potential conservation concern: four species native to the extreme north should be considered Vulnerable, and one species and one subspecies are considered Data Deficient but likely to be at risk.

Key words: *Dombeya*, *Helmiopsis*, IUCN Red List, Madagascar, Malvaceae.

Helmiopsis H. Perrier is among a considerable number of endemic Malagasy genera of Malvaceae s.l.; it was formerly placed in Sterculiaceae and may have affinities to genera such as *Dombeya* Cav. or *Nesogordonia* Baill. It is characterized by features including a lepidote indument on inflorescences, sepals, ovaries, petioles, and usually twigs and leaves; biseriate perianth with well-developed, not ligulate or appendiculate petals; usually apically winged ovules and seeds; short androecial corona, with groups of fertile stamens alternating with staminodes; and glandular sepals and often petals. At the time of the last complete taxonomic

revision (Arènes, 1959), little material was available, with four of the eight species and one variety described from a single specimen, and only a handful of collections available for most of the others. Many more specimens have since been collected, especially in the extreme north of Madagascar, to which several species are endemic. This additional material has enabled better understanding of the genuine range of morphological variation within the genus and of the geographic distribution of the more common species, both of which were underrepresented in Arènes' (1959) treatment. A revision is therefore presented in which nine species are

¹ I thank the Muséum national d'Histoire naturelle (P) and the Parc Botanique et Zoologique de Tsimbazaza (TAN) and curators thereof for access to collections and for loan of specimens from P; P. P. Lowry II and P. B. Phillipson for hospitality at P and helpful discussion; R. Halse, M. Koopman, T. Charron, V. Hollowell, B. Parada, and A. Brock for helpful comments and editing; R. Gereau for help with the Latin diagnoses; B. Alongi for illustrating new taxa; F. Keusenkothen for computer assistance; and D. Bills and T. Distler for the maps.

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doi: 10.3417/2007184

recognized; one species is newly described, and one more placed into synonymy.

TAXONOMIC HISTORY

Perrier de la Bâthie (1944) described *Helmiopsis* with a single species, *H. inversa* H. Perrier, and two named varieties (not validly published due to the lack of a Latin diagnosis, as required by Art. 36.1 of the International Code of Botanical Nomenclature [ICBN; McNeill et al., 2006]) from a total of four specimens he had collected in western Madagascar. Simultaneously, he described three new species of *Nesogordonia* Baill., the type of which had been doubtfully placed in Theaceae, and observed that the two genera were clearly related and both better referred to Sterculiaceae. Capuron (1952) proposed to transfer two species previously placed within *Dombeya* (*D. richardii* (Baill.) Baill., *D. pseudopopulus* Baill.) to *Helmiopsis*, though the new combinations were not validly published. He acknowledged Perrier's placement of *Helmiopsis* and *Nesogordonia* within Sterculiaceae, remarking on similarities between the wood of those genera and that of *Mansonia* J. R. Drumm. ex Prain (Sterculiaceae), while suggesting a possible affinity to Tiliaceae. Arènes (1956a, b, 1959) also recognized *Helmiopsis* as belonging to Sterculiaceae; that entire family is now included within Malvaceae s.l. (Bayer et al., 1999).

Helmiopsis was last treated in full by Arènes (1956a, b, 1959). Arènes (1956a) recognized only two species, one of them based upon one of Perrier's (1944) invalidly published varieties of *H. inversa*; he rejected Capuron's (1952) view that *Dombeya richardii* and *D. pseudopopulus* should be placed within *Helmiopsis*. However, Arènes (1956b) published a revision recognizing eight species, including both of Capuron's additions as well as two other former *Dombeya* species. He placed the newly described *H. hily* Arènes alone in subgenus *Phelmiosis* Arènes due to its reduced number of carpels and the remainder in subgenus *Mihelopsis* Arènes. Publication of the former subgenus automatically established the corresponding autonym of subgenus *Helmiopsis* for the subgenus including the type (necessarily *H. inversa*) under Article 22.3 of the ICBN (McNeill et al., 2006), and "subgen. *Mihelopsis*," by including that type, was not validly published under Article 22.2. Within that group, section *Nudipetalae* Arènes—again, not validly published—comprised four species with relatively narrow leaves, numerous stamens (15 to 30), and nonglandular petals, while section *Glandulipetalae* Arènes comprised three species, including *H. richardii* (Baill.) Capuron ex Arènes and *H. pseudopopulus* (Baill.) Capuron ex Arènes, which are characterized by broad leaves, normally 10

stamens, and $\pm$ glandular petals. The latter group is confined to a few areas at the northern tip of Madagascar, whereas the remaining species are more broadly distributed.

Arènes (1959) renamed his infrageneric groups to conform to the rules of nomenclature, subgenus *Mihelopsis* and section *Nudipetalae* becoming subgenus and section *Helmiopsis*, respectively, and largely maintained the same treatment of species. In two works (Arènes, 1956a, 1959), he recognized the invalidly published *Helmiopsis inversa* var. *arenicola* H. Perrier as a distinct variety, while unfortunately never validating it. Barnett (1987) described a new northern species, *H. sphaerocarpa* L. C. Barnett, which has certain features unique within the genus (virtual absence of a seed wing, spheroid capsule) but clearly belongs to section *Glandulipetalae*.

Dorr (2001) has also recently transferred *Dombeya rigida* Baill. to *Helmiopsis*. *Dombeya rigida* and its apparent sister species, *D. linearifolia* Hochr., were treated by Arènes (1958, 1959) as *Dombeya* subsect. *Rigidae* Arènes, characterized by scorpioid cymes and glandular petals. Subsection *Rigidae* is placed within section *Capricornua* Hochr., the remainder of which have scorpioid cymes but glabrous petals. The ovules and seeds of *D. rigida* bear a shallow marginal wing; according to Arènes' (1959) treatment of Malagasy Sterculiaceae, winged seeds would place the species within the tribe Helmiopsidae Arènes, rather than in Dombeyeae Benth. & Hook. Characters that would then place *D. rigida* within *Helmiopsis* rather than a related genus include a monadelphous androecium, with stamens borne opposite the sepals and staminodes opposite the petals, and glabrous locules (Dorr, 2001). (Stamen position was treated by Arènes as being a reliable character at the generic level, but actually is more variable within certain genera than usually recognized, and indeed appears to vary within *D. rigida* itself.) This placement may be regarded as controversial. *Dombeya rigida* (and *D. linearifolia*) would be anomalous in *Helmiopsis*, lacking a number of characters common within the genus, and most of the characters that are shared with species of *Helmiopsis* can also be seen in some other species of *Dombeya*, although glandular petals are otherwise atypical of the latter genus. *Dombeya* is an exceedingly variable genus, and the possibility that it is paraphyletic or polyphyletic relative to other Malagasy genera of Malvaceae s.l. cannot be discounted.

MORPHOLOGICAL CHARACTERS

VEGETATIVE CHARACTERS

All species of *Helmiopsis* are woody plants, usually reported to be trees or large shrubs; some reach to

20 m in height. Twig bark is grayish to dark reddish brown, shallowly ridged, with small pale lenticels; in all but one species, young twigs are at least sparsely lepidote or scaly. Leaves are alternate, simple, and stipulate; the stipules, where known, are small and inconspicuous, lepidote, and always rapidly caducous. Petioles are always lepidote. Shape and size of the leaf blade and relative length of the petiole are quite variable, as is the shape of the leaf apex. Section *Helmiopsis* has relatively narrow leaves, with length usually well exceeding breadth, and petioles that, except in one species, seldom exceed 1.5 cm long; section *Glandulipetalae* has leaves ranging from broadly ovate to orbicular, in one species the breadth well exceeding the length, and with petioles frequently 2 cm to several centimeters long. The leaf base ranges from rounded to rounded-truncate or shallowly cordate; the margins are usually entire to weakly undulate or weakly repand, but may be crenulate to crenate-serrate. Both leaf surfaces or at least the abaxial surface are lepidote in most species; one species has entirely glabrous leaves, while another has sparse stellate pubescence on the adaxial surface and typical scales abaxially. All but one species of section *Helmiopsis* have three or sometimes five basal veins, with the lateral veins weak and inconspicuous, so that venation is basically pinnate; species of section *Glandulipetalae* have five to seven well-developed palmate veins at the base. Most species can be differentiated solely by their leaf morphology.

INFLORESCENCE

Inflorescences are cymose or geminate; cymes may be well developed with elongated peduncles and several orders of branching (a character seen only in section *Glandulipetalae*) or small, few-flowered, and sometimes umbelliform. Inflorescences are normally lateral; only one species seems to produce genuinely terminal inflorescences, although several species may appear to have terminal inflorescences due to tight clustering of cymes at the tips of twigs. Bracts and bracteoles, where known, are small and rapidly caducous. Pedicels are angular, except in one species with subterete pedicels, and are articulated at the point of insertion of the bracteoles, which may be immediately beneath the bud or well below it. All parts of the inflorescence are lepidote.

CALYX

Sepals are more or less lanceolate, fused only at the base, and lepidote, and have a patch of glandular tissue on the inner surface near the base that varies in extent and visibility. This has been presumed to be

absent in some species, including all of those that have glandular petals; Barnett (1987) was the first to note both sepal and petal glandularity in the newly described *Helmiopsis sphaerocarpa*. In fact, in all species of *Helmiopsis*, very small relict patches of apparently glandular tissue remain within the basalmost portion of the calyx, where they are not readily observed. Sepals are sometimes reflexed in section *Glandulipetalae*, but generally not so far as to display the glandular tissue.

Similar small basal spots of glandular tissue were noted by Hochreutiner (1926) in a species of *Dombeya* sect. *Capricornua* (*D. urenoides* Hochr.). Specimens of other species of that section (including *D. borraginopsis* Hochr., *D. greveana* Baill., and probably *D. marivorahonensis* Arènes and *D. triumfettifolia* Bojer) have been observed to have tiny glandular patches within the basalmost fused portion of the calyx, although *D. rigida* and *D. linearifolia* do not. The character is also more widely distributed both in *Dombeya* subg. *Dombeya* (e.g., *D. cacuminum* Hochr.) and in subgenus *Xeropetalum*, including virtually all species of section *Decastemon* (pers. obs.; in prep.) as well as some species of section *Xeropetalum* (e.g., *D. rienanensis* Appleq. [Applequist, 2009]). However, some species in both subgenera lack sepal glands. Similar sepal glands might represent evidence of affinities between *Dombeya* subg. *Dombeya* and *Helmiopsis*; however, many distantly related genera of Malvaceae also bear nectary tissue on the sepals (Vogel, 2000).

COROLLA

Petals vary in size, caducousness, and in the presence or absence of small rounded, easily detached surface glands on the basal portion of the adaxial surface. They are generally obovate, occasionally obdeltoid or orbicular, whitish or pale-colored, and often flimsy in texture; they sometimes have a markedly asymmetrical apex and frequently seem to be caducous.

ANDROECIUM

The androecium varies in the depth of the fused basal corona, the number of stamens, and the relative length and shape of the staminodes, filaments, and anthers. Staminodes may be shorter or longer than fertile stamens, which are borne in five groups alternating with the staminodes; staminodes are longer than the stamens in section *Glandulipetalae* and one species of section *Helmiopsis*, *H. glaberrima* Arènes. Traditionally, *Helmiopsis* is described as having oppositisealous stamens, as do many other plants,

and oppositipetalous staminodes; this is one of the features that is said to differentiate it from *Dombeya*, which, like a few other Malagasy genera of Malvaceae s.l., usually has oppositipetalous stamens and oppositisepalous staminodes (Arènes, 1959). However, this character proves to be more variable than generally believed. *Helmiopsis* specimens referable to section *Glandulipetalae* and one other species, *H. hily*, usually have more or less oppositisepalous staminodes, although some degree of apparent variation in stamen and staminode position can be seen even within individuals. Intermediate positions of these organs, not clearly opposite either petals or sepals, do occur.

OVARY AND FRUIT

The ovary is lepidote and 5-carpellate except in one species, *Helmiopsis hily*, which has three or occasionally four carpels; ovary lobing, style length and scaliness, and conformation of stigma branches are variable. All but one species of section *Helmiopsis* have relatively long, spreading to recurved branches, whereas all species of section *Glandulipetalae* have short, erect, tightly appressed lobes. The fruit is a loculicidal capsule, which varies in shape and color. According to Arènes (1959), one of the distinctions between *Helmiopsis* and *Helmiopsiella* Arènes is that the locules of the former are internally glabrous rather than pubescent. However, mature fruits of *Helmiopsis boivinii* (Baill.) Arènes (including the type of *H. inversa*, the type of the genus) have small white-pubescent patches on the basalmost portion of the septa and the central portion of the base of the fruit. Ovules and seeds of *Helmiopsis* s. str. usually bear an elongated apical wing, at least as long as the seed proper; one species, *H. sphaerocarpa*, has at most an inconspicuous ventral ridge. Seeds may number one or two per locule; if two, one is generally larger and better developed. Fruits and mature seeds of some taxa are not known.

TAXONOMIC TREATMENT

The major taxonomic issue in defining *Helmiopsis* is whether it shall be circumscribed so as to encompass *Dombeya rigida*, as proposed by Dorr (2001), and presumably its sister species *D. linearifolia*, or whether these species shall be excluded, following the traditional circumscription (sensu Arènes, 1959). Only the winged seed, often oppositisepalous stamens, and glandular petals supported placement within *Helmiopsis* rather than *Dombeya*. Winged ovules were taken to be the most critical character by Dorr (2001), but it is not clear that the curved, shallow marginal

wing of *D. rigida* is homologous with the narrow, prominently elongated apical wing of most *Helmiopsis* species (excluding *H. sphaerocarpa*). The seeds of *D. linearifolia* are not winged. If the petal glands were homologous to those in *Helmiopsis*, it would reflect specific affinities to section *Glandulipetalae*, with which *D. rigida* and *D. linearifolia* also share stamens that are shorter than the staminodes and normally 10 in number. One would therefore expect the latter species to possess some of the features that are otherwise common to all species of *Helmiopsis*, and presumably plesiomorphic within the genus. However, they in fact lack several such features, including lepidote pubescence on at least some organs, glandular tissue on the sepals, and rapidly caducous bracteoles (Table 1). Furthermore, the members of section *Glandulipetalae* usually have oppositipetalous stamens. *Dombeya rigida* and *D. linearifolia* also display characters that are seen in other *Dombeya* species but not in *Helmiopsis*, such as cymes with scorpioid branches. Thus, no matter where these species are placed, considerable morphological divergence from close relatives must be postulated. As noted, patterns of morphological variation within *Dombeya* are complex and difficult to interpret, and the monophyly of the genus is not proven. Pending the availability of molecular data that may address these issues (C. Skema, pers. comm.), it seems most conservative to leave *D. rigida* and *D. linearifolia* within *Dombeya* subsect. *Rigidae*. It is plausible that *Helmiopsis* may prove to be embedded within *Dombeya* as presently defined, although the status of *Helmiopsis* as a natural group worthy of recognition at some level is not in question, given the presence of several apparent morphological synapomorphies.

Arènes' (1956, 1959) infrageneric classification is modestly rearranged herein. The distinction between section *Glandulipetalae* and section *Helmiopsis* (both within subgenus *Helmiopsis*, according to Arènes) is easily made by vegetative as well as reproductive morphology, and recognition of these sections is maintained. *Helmiopsis hily*, the single species placed by Arènes within subgenus *Phelmiosis*, has for the most part typical features of section *Helmiopsis* and is here included within that section; the reduction in carpel number to usually three is certainly an autapomorphy and there is no reason to suppose that this species is sister to the remainder of the genus. No division of the genus at the subgeneric level is therefore recognized. In the absence of reproductive data, species are defined pragmatically by the recognition of unique suites of morphological characters. Nine species and one subspecies are recognized, of which one species and the subspecies are newly described.

Table 1. Morphological distinctions among *Helmiopsis* sect. *Glandulipetalae* (four species), *Helmiopsis* sect. *Helmiopsis* (five species), and *Dombeya* subsect. *Rigidae* (*Dombeya rigida* and *D. linearifolia*).

	<i>Helmiopsis</i> sect. <i>Glandulipetalae</i>	<i>Helmiopsis</i> sect. <i>Helmiopsis</i>	<i>Dombeya</i> subsect. <i>Rigidae</i>
Vegetative, inflorescence, and sepal pubescence	lepidote throughout	usually lepidote throughout; leaves of one species stellate adaxially	stellate throughout, or sometimes with scurfy scales on twigs
Inflorescence	dichotomously branching cymes or geminate	cymose, geminate or solitary, always small	cymes with scorpioid branches
Bracteoles	rapidly caducous	usually rapidly caducous; where sometimes persistent, not enveloping bud	often persistent in bud; relatively large and broad, convex, sometimes enclosing buds
Sepal glands	present in small, inconspicuous patches inside base	present, sometimes in large noticeable patches	absent
Petal glands	present	absent	present
Stamen position	+ opposite petals	+ opposite sepals, except in one species	+ opposite sepals
Androecial conformation	fertile stamens 10, shorter than staminodes	fertile stamens 15 to 30, longer than staminodes except in one species	fertile stamens 10, shorter than staminodes
Ovary pubescence	lepidote	lepidote	stellate
Seed morphology (where known)	bearing an elongated apical wing, or a narrow keel in one species	bearing an elongated apical wing	bearing a shallow wing around most of seed margin, or wingless

Helmiopsis H. Perrier, Bull. Soc. Bot. France 91: 230. 1944. TYPE: *Helmiopsis inversa* H. Perrier.

Trees or shrubs; twig bark grayish to dark reddish brown, shallowly ridged, with small pale lenticels; young twigs lepidote or occasionally glabrous. Leaves alternate, stipulate, petiolate, simple, variable in shape; stipules small, $\pm$ lanceolate, lepidote, rapidly caducous; petiole lepidote or occasionally glabrous; leaf base rounded to shallowly cordate or rounded-truncate; margins entire to weakly undulate, weakly repand, crenulate, or crenate-serrate; at least the abaxial surface usually lepidote, occasionally glabrous or the adaxial surface sparsely stellate-pubescent. Inflorescences cymose, ranging from small and sometimes umbelliform to well developed with several orders of branching, or geminate, usually lateral, occasionally terminal or pseudoterminal; bracts where present small, rapidly caducous; all parts of inflorescences lepidote. Flowers actinomorphic, hermaphroditic, pedicellate; pedicels angular or occasionally subterete, articulated at the point of insertion of bracteoles; bracteoles 3, small, lanceolate to ovate, lepidote, rapidly caducous, inserted immediately below bud or well below bud on pedicel; sepals 5, free except at extreme base, lanceolate, lepidote, normally bearing at least small patches of glandular tissue on the adaxial surface near the base; petals 5, free, obovate to obdeltoid or orbicular, frequently caducous, in section *Glandulipetalae* bearing small

round glands on basal half of adaxial surface; androecium basally fused into a short corona; fertile stamens 10 to 30 (very rarely 5 in aberrant individuals), borne in 5 groups alternating with spatulate to oblong or oblong-obovate staminodes; stamens may be shorter than staminodes and $\pm$ oppositipetalous or longer than staminodes and usually $\pm$ oppositisepalous, with filaments of the latter group sometimes basally fused into fascicles; anthers linear to oblong; gynoecium (3- to)5-carpellate; ovary syncarpous, superior, lepidote, sometimes lobed; style lepidote basally or throughout; style lobes (3 to)5, short, erect, and clustered, or well developed and usually recurved to spreading. Fruit, where known, a loculicidal capsule, variably shaped, sometimes lobed; seeds 1 or 2 per locule, apically winged or occasionally unwinged.

Distribution and habitat. *Helmiopsis* comprises nine species, all endemic to Madagascar. The greatest diversity within the genus is at the northern tip of the island, but species of section *Helmiopsis* are native to northwestern and southwestern Madagascar. Habitats include forest, scrub, and coastal dunes; substrates include sand, limestone, alluvial soil, and basalt.

KEY TO SECTIONS OF *HELMIOPSIS* IN MADAGASCAR

- 1a. Leaves elliptical to ovate, lanceolate, or oblong; petioles relatively short, less than 15(–28) mm

- long; inflorescences 1- to 5-flowered; petals not glandular; stamens 15 to 30 section *Helmiopsis*
1b. Leaves broadly ovate to orbicular or transversely elliptical; petioles usually over 15 mm, to several centimeters long; inflorescences variable; petals glandular; stamens 10 section *Glandulipetalae*

I. *Helmiopsis* sect. *Helmiopsis*.

Helmiopsis subg. *Phelmiosis* Arènes, Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 415. 1956.

Trees to 10 m high or shrubs, sometimes large; twig bark grayish to dark reddish brown, shallowly ridged, with small pale lenticels; young twigs lepidote or glabrous. Leaves variable, lanceolate-oblong to elliptical, ovate, or broadly ovate, seldom very broad; petiole lepidote or glabrous; basal veins 3(5), inconspicuous; base rounded or shallowly cordate; apex rounded to acute, variably emarginate in some species; margins entire to weakly undulate; abaxial surface lepidote or glabrous; adaxial surface lepidote, glabrous, or sparsely pubescent with flat stellate hairs; stipules where known less than 1.5 mm, rapidly caducous. Inflorescences lateral, geminate or 3- to 4(to 5)-flowered cymes, sometimes umbelliform, or 1-flowered, often clustered near twig apices; occasional bracts very small, rapidly caducous; bracteoles rapidly caducous, sometimes ovate and persisting in smaller buds; pedicels angular to subterete, articulated; inflorescences lepidote throughout. Sepals narrowly lanceolate, lepidote, with sometimes conspicuous patches of glandular tissue on basal portion of adaxial surface; petals obovate to obdeltoid or orbicular, not glandular; fused base of androecium coroniform, sometimes almost absent; fertile stamens 15 to 30, usually $\pm$ oppositisepalous,

in one species frequently oppositipetalous; staminodes spatulate to oblong or oblong-obovate, shorter than longest stamens; filaments free to corona or basally fused into fascicles; anthers linear to oblong; gynoecium (3- to)5-carpellate; ovary lepidote, sometimes lobed; style lepidote basally or throughout; style lobes well developed, recurved to spreading or erect and appressed in one species. Fruit where known, a capsule, variable in shape, sometimes lobed; seeds where known, 1 or 2 per locule, apically winged.

Distribution. *Helmiopsis* sect. *Helmiopsis* ranges from the northern end of Madagascar to the arid southwest (Fig. 1).

Discussion. *Helmiopsis glaberrima*, a rare northern species for which only one specimen is known, complicates the distinction between section *Helmiopsis* and section *Glandulipetalae*. Its affinities are clearly with section *Helmiopsis*, as it has narrow leaves, 15 oppositisepalous stamens, small inflorescences, well-developed sepal gland patches, and long style lobes. However, it displays a few characters (normally five basal leaf veins, relatively long petioles, fertile stamens shorter than the staminodes, and erect, appressed style lobes) that are otherwise typical of section *Glandulipetalae*. The hypothesis tentatively favored by this author is that *H. glaberrima* is sister to the remainder of section *Helmiopsis*, and that the few characters shared with section *Glandulipetalae* are plesiomorphic within *Helmiopsis*. However, an alternate hypothesis is that section *Helmiopsis* is paraphyletic, with *H. glaberrima* actually being the sister taxon of section *Glandulipetalae*.

KEY TO THE SPECIES OF *HELMIOPSIS* SECT. *HELMIOPSIS* IN MADAGASCAR

- 1a. Leaves glabrous; stamens shorter than staminodes; style branches erect 3. *H. glaberrima*
1b. Leaves lepidote at least abaxially; stamens longer than staminodes; style branches spreading or recurved.
2a. Leaves narrowly lanceolate to lanceolate, mostly less than 2 cm broad; adaxial surface glabrous, abaxial surface densely lepidote, pale or silvery green; stamens 15; ovary and fruit 3-carpellate, deeply 3-lobed 4. *H. hily*
2b. Leaves variable in shape, not narrowly lanceolate, often over 2 cm broad; adaxial surface glabrous or sparsely stellate or lepidote, abaxial surface variably lepidote; stamens (15 to)20 to 30; ovary and fruit 5-carpellate, not conspicuously lobed.
3a. Leaves narrowly ovate to lanceolate, adaxial surface weakly pubescent with flat stellate hairs; sepals 11–13 mm long; petals 14–17 mm long, pale yellow with pale pink highlights 2. *H. calcicola*
3b. Leaves variable in shape, adaxial surface lepidote to glabrous; sepals less than 11 mm long; petals less than 13 mm long, sometimes white.
4a. Leaves ovate to elliptical, broadly ovate, or lanceolate; pedicels (6–)8–16(–19) mm long, not much elongated in fruit; petals (6–)10–13 mm long, obovate to obdeltoid; stamens (15 to)20 to 25; staminodes spatulate, 2.8–4(–5) mm long 1. *H. boivinii*
4b. Leaves oblong-elliptical to elliptical or lanceolate, rarely ovate; pedicels 3–6 mm long, in fruit up to 10 mm; petals 8.2–9.3 mm long, suborbicular; stamens 30; staminodes oblong-obovate, 2.7–3.1 mm long 5. *H. polyandra*

1. *Helmiopsis boivinii* (Baill.) Arènes, as “*Boivini*,” Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 418. 1956. Basionym: *Trochetia boivinii* Baill., as “*Boivini*,” *Adansonia* 10: 109–110. 1871. *Dombeya boivinii*

(Baill.) Baill., as “*Boivini*,” Bull. Mens. Soc. Linn. Paris 1: 496. 1885. TYPE: Madagascar. Mahajanga: Ambongo, 14 Feb. 1841 (fl.), A. Pervillé 642 (holotype, P!; isotypes, G not seen, P!).

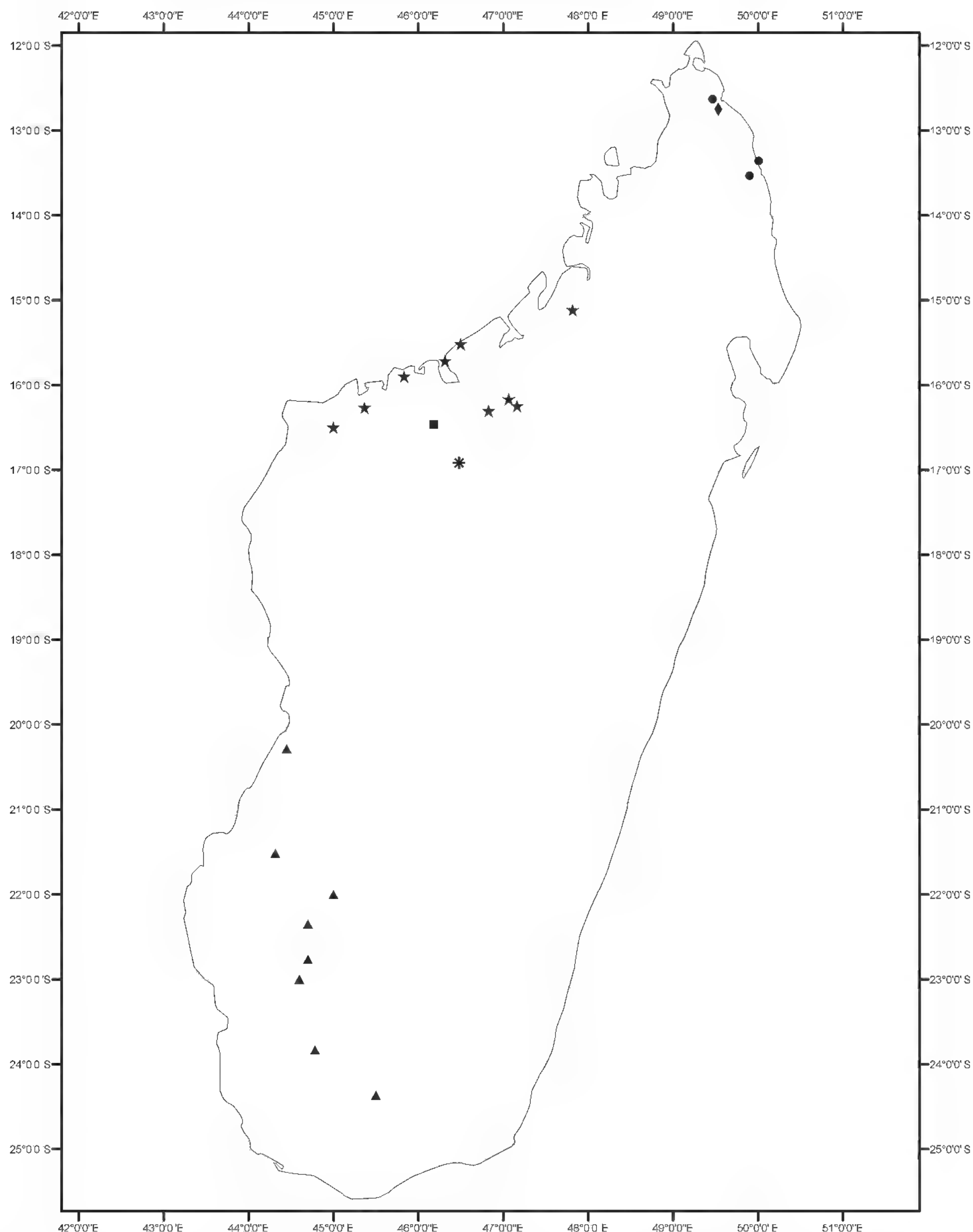


Figure 1. Approximate distribution of species of *Helmiopsis* sect. *Helmiopsis* (★ = *H. boivinii*; * = *H. calcicola*; ◆ = *H. glaberrima*; ▲ = *H. hily* subsp. *hily*; ■ = *H. hily* subsp. *boinensis*; ● = *H. polyandra*).

Helmiopsis inversa H. Perrier, Bull. Soc. Bot. France 91: 230. 1944, syn. nov. TYPE: Madagascar. Mahajanga: Ampasimarina [15°31'S, 046°30'E] au N de Majunga [Mahajanga], 27 May [1932?] (fr.), *H. Perrier de la Bâthie* 17986 (lectotype, designated here, P!; isotypes, P!, TAN!).

Shrub to 4 m high or tree to 10 m high, 20 cm diam.; bark grayish, sometimes splotched, with pink-orange slash; twig bark grayish, shallowly ridged, with small pale lenticels; young twigs lepidote. Leaves ovate to elliptical, broadly ovate, or lanceolate, (2.5–) 3.6–7.3(–8.4) × (1.4–) 1.7–3.8(–4.5) cm, frequently

caducous; petiole 7–15(–18) mm, densely lepidote; basal veins 3(to 5), the lateral weak; base rounded to very shallowly cordate; apex rounded or acute with rounded tip, occasionally slightly emarginate; margins entire to slightly undulate; both surfaces lepidote in young leaves, sparsely so in older leaves, the adaxial surface sometimes becoming glabrous; scales of leaves and petioles variable in size and shape, occasionally fimbriate; stipules less than 1 mm, lepidote, rapidly caducous and very rarely present. Inflorescences up to 4(to 5)-flowered cymes, often umbelliform, or gemi-

nate or flowers occasionally single, borne laterally, mostly near twig apices; usually only 1 or 2 flowers per inflorescence maturing; bracts less than 1.2 mm, deltoid, rapidly caducous; pedicels $\pm$ angular, articulated, (6–)8–16(–19) mm, becoming woody in fruit; bracteoles 3, borne near base of flower, deltoid, caducous, ca. 1 mm; inflorescences lepidote throughout. Sepals narrowly lanceolate, (6.5–)8.5–11 mm, pale green to whitish, lepidote, the adaxial surface basally glandular; petals white, (6–)10–13 $\times$ (4–)6–8.2 mm, obovate to obdeltoid; androecial corona 0.5–1 mm; fertile stamens (15 to)20 to 25, in groups of (3 to)4 to 5, opposite sepals, white; filaments 2.5–4.8 mm, often free to corona, occasionally fused at the base into distinct fascicles; anthers linear-oblong, 2.3–3.5(–4.1) mm; staminodes spatulate, 2.8–4(–5) mm, shorter than longest stamens; gynoecium 5-carpellate; ovary lepidote, white; style lepidote mostly on lower portion, 3–5 mm; style lobes erect and spreading or rarely recurved, (0.6–)1–2.3 mm. Fruit a woody capsule, (11–)13–19 mm, ovoid to cylindrical, sometimes with apparently swollen base or constriction above the base, sometimes 5-ribbed or shallowly lobed, lepidote, pale brown to blackish brown at maturity; central base of capsule inside and basalmost part of septa often white-pubescent, hairs sometimes fused at base into flat clusters; seeds (2.5–)3.4–4.5 mm with often asymmetrical 5.2–8.5 mm apical wing, 2 per locule, only 1 well developed.

Distribution, phenology, and habitat. Most collections are from a limited area of northwestern Madagascar, including localities around Mahajanga, the Ankarafantsika reserve, and the Ambongo region (Fig. 1); only a few clearly distinct populations have been collected. The habitat is on sand, including coastal dunes, in scrub or forest; reported altitudes range up to 200 m. Existing flowering collections are from November to February, with buds seen in May; fruiting may occur at almost any time of year, with developing or undehiscent fruits collected in February, March, June, August, and November.

IUCN Red List category. Provisional IUCN Red List category (IUCN, 2001) is noted as Least Concern (LC).

Common names and uses. Mainaty (*Réserves Naturelles* 2067, 2568, 2832, 2944; *Service Forestier* 12666); Maintinaty (*Service Forestier* 14785); Amonty (*Service Forestier* 50); Selivato (*Service Forestier* 15782). The wood has been used in construction (*Service Forestier* 12666).

Orthography. Under Article 60.11 of the ICBN (McNeill et al., 2006), the original spelling (“*boivini*”) of the epithet of *Helmiopsis boivinii* is treated as an

error to be corrected, as Arènes (1959) did in his *Flore de Madagascar* treatment.

Discussion. There is no qualitative distinction between *Helmiopsis boivinii* and *H. inversa*, which are native to the same region of northwestern Madagascar. The more frequently collected populations that have been called *H. inversa* display considerable variation in such characters as leaf size and shape, leaf pubescence and scale morphology, and fruit shape. However, these characters do not vary in concert, nor are they consistently correlated with locality of origin. In 1963, Capuron determined specimens of *H. inversa* at P as *H. boivinii*, indicating that he thought the two taxa should be combined, but does not appear to have published this treatment. *Helmiopsis boivinii* and the invalidly published *H. inversa* var. *arenicola* H. Perrier were each described based on single specimens from Ambongo, an area where classic *H. inversa* has not been collected, and are distinguished by their somewhat larger leaves and smaller flowers. However, the increased leaf size and reduced petal size seen at Ambongo do not significantly exceed the extremes from collections at other repeatedly collected localities. Moreover, the types of these two putative taxa appear to be in early rather than full flower, and it is possible that the availability only of incompletely developed flowers reduced the apparent petal size. Therefore, there seems to be inadequate reason to formally distinguish the Ambongo population from other populations in the region at any taxonomic level.

Although *Helmiopsis inversa* is the type species for the genus, the epithet of *H. boivinii* predates its publication and thus has precedence when the two are combined. Perrier de la Bâthie (1944: 231) listed two specimens, *Perrier de la Bâthie* 17986 and 13858, as “[t]ypes du genre et de l’espèce [*H. inversa*].” The latter number seems to be a misprint, as the only similar Perrier specimen at P, from the same locality (Ampasimana au N de Majunga) and date (July 1921), is clearly numbered 13838. Arènes (1956b, 1959) listed *Perrier de la Bâthie* 13838 and 17986 as types in view of this fact. It appears that neither specimen has ever been selected to serve as a single lectotype. *Perrier de la Bâthie* 17986 is herein chosen because it is in better condition, with buds as well as old fruit, and three duplicates exist; this choice also avoids any argument over whether the specimen whose number was misstated can be considered original material.

Representative specimens examined. MADAGASCAR. **Mahajanga:** several km N of Majunga [Mahajanga; 15°43’S, 046°19’E], vic. Zaha Motel, *Barnett et al.* 478 (MO, TAN); Namakia–Dunes de Boeny Ampasy, S/P. de Mitsinjo [15°54’S, 045°50’E], *Debray* 1442 (P); dunes, Ampasimarina [15°31’S, 046°30’E] au N de Majunga

[Mahajanga], *Perrier de la Bâthie* 13838 (P); RN4, Réserve forestière d'Ampijoroa, Jardin Botanique B, à l'E du Lac Ravelobe, 16°18'19"S, 046°49'38"E, *Randrianaivo et al.* 399 (MO); Ankarafantsika, canton Tsaramandroso, distr. Ambato-Boeni [RN7, 16°10'S, 047°04'E], *Réserves Naturelles* 2067 (MO, P, TAN); 7è Réserve [Ankarafantsika], Ligne Bépilo, *Service Forestier* 50 (P); W du village de Bevazaha [16°14'50"S, 047°09'50"], canton de Tsaramandroso, distr. d'Ambato-Boeni, *Service Forestier* 12666 (P); forêt Analalava, Maintirano, *Service Forestier* 14785 (MO); forêt tout près de Maherivaratra, village le plus proche Ambodibonara, canton Ankerika [14°57'S, 047°52'E], distr. Antsohihy, *Service Forestier* 15782 (P, TAN); près d'Ampasimariny [15°31'S, 046°30'E], au NE de Majunga, *Service Forestier* 24317 (MO, P).

2. *Helmiopsis calcicola* Arènes, Mém. Inst. Sci. Madagascar, Sér. B, Biol. Vég. 7: 55–56. 1956. TYPE: Madagascar. Antsiranana: forêt tropophile sur rocailles calcaires, Kama-Kama, sur le plateau d'Ankara (Boina) [16°55'S, 46°29'E], v. 100 m alt., Jan. 1900 (fl.), *Perrier de la Bâthie* 1018 (holotype, P!; isotypes, P [2!]).

Shrub, 2–3 m high, with hard wood; twig bark grayish, shallowly ridged, with small pale lenticels; young twigs yellowish, lepidote. Leaves narrowly ovate to lanceolate, (3.5–)6–8.5 × (1.3–)2.3–3.5 cm, caducous, membranous; petiole 4–12 mm, densely lepidote; basal veins 3, the lateral weak; base rounded; apex acute; margins entire; abaxial surface lepidote, adaxial surface sparsely pubescent with flat stellate hairs, especially along midrib; stipules ca. 1 mm, deltoid, lepidote, usually caducous. Inflorescences few-flowered, axillary, probably mostly geminate with peduncle less than 2 mm; pedicels ± angular, articulated, ca. 10–16 mm; bracteoles inserted below base of flower; peduncles and pedicels lepidote. Sepals narrowly lanceolate, 11–13.2 mm, lepidote, the basal half of the adaxial surface glandular and reddish; petals pale yellow with pale pink highlights, 14–17 × 9–11 mm, obovate with asymmetrical apex; androecial corona 0.6–1 mm; fertile stamens ca. 30, in groups of (5 to)6(to 7), opposite sepals; filaments red, 2.5–4.8 mm; anthers yellow, linear-oblong, 2.3–3.5(–4.1) mm; staminodes reddish, spatulate to oblong, 3.5–4.8 mm; gynoecium 5-carpellate; ovary lepidote, 5-ribbed; style pale yellow, lepidote throughout, 4–4.5 mm; style lobes recurved, 3–4 mm. Fruit unknown.

Distribution, phenology, and habitat. The only known collection is from the Ankara region of northwestern Madagascar (Fig. 1); the species was flowering in January 1900.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Data Deficient (DD). This area has been inadequately collected, so a lack of collections is not necessarily evidence of rarity.

However, the fact that the region has suffered considerable habitat degradation is cause for concern.

Discussion. This is the only species of *Helmiopsis* that has more or less stellate pubescence in addition to lepidote scales; the stellate pubescence is sparse and confined to the adaxial leaf surface. Arènes (1956) based this species on *H. inversa* var. *calcicola* H. Perrier (Bull. Soc. Bot. France 91: 230. 1944), which was not validly published, as the description was given only in French, with no Latin diagnosis, which the ICBN required for taxa published after 1935 (Art. 36.1; McNeill et al., 2006). Arènes' name was accompanied by a full Latin description and so was validly published.

3. *Helmiopsis glaberrima* Arènes, Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 417. 1956. TYPE: Madagascar. Antsiranana: Analamerana, Diégo-Suarez [12°45'S, 49°32'E], 16 Mar. 1954 (fl.), *Service Forestier* 9423 (holotype, P!; isotypes, MO!, P not seen).

Woody plant; twigs dark reddish brown, shallowly ridged, glabrous, with pale tan elliptical lenticels. Leaves lanceolate-oblong, 4–7.3 × 1.4–2.5 cm; petiole (4–)13–28 mm, glabrous, those at ends of twigs much shorter; basal veins 5, the lateral ones weak; base shallowly cordate; apex rounded-acute; margins entire; both surfaces glabrous; stipules caducous. Inflorescences geminate or 3-flowered cymes, lateral and pseudoterminal, clustered at twig ends; peduncle 11–17 mm, dark reddish brown, woody, sparsely lepidote; pedicels articulated, nearly terete, lepidote, ca. 6.5–8 mm; bracteoles inserted well below flower. Sepals narrowly lanceolate, 8.2–9 mm, lepidote, the basal half of the adaxial surface glandular; petals 12–14 × 9–10 mm, broadly obovate with clawed base; androecial corona 1.5–1.9 mm; fertile stamens ca. 15, in groups of (2 to)3(to 4), oppositisealous; filaments 0.5–1 mm, fused into fascicles; anthers linear, 2.5–3.1 mm; staminodes spatulate, 6.5–7.5 mm; gynoecium 5-carpellate; ovary deeply 5-lobed, lepidote; style lepidote only at base, 4.5–5.1 mm; style lobes erect and closely appressed, 1.2–1.4(–2) mm; ovules elongated, apparently apically winged. Fruit unknown.

Distribution, phenology, and habitat. The only known collection is from the extreme north of Madagascar (Fig. 1); it was flowering in March.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Vulnerable (VU D2). Only a single location is known, from the Analamera Special Reserve, and the area of occupancy is likely to be very small. Several remaining patches of

northern forest are relatively accessible and have been repeatedly collected; multiple specimens of more than one species of *Helmiopsis* sect. *Glandulipetalae* have been collected from certain areas. Thus, the lack of additional collections of this species suggests that it is indeed relatively rare and of limited distribution.

Discussion. *Helmiopsis glaberrima* is the only species of section *Helmiopsis* in which the staminodes are longer than the fertile stamens, as in section *Glandulipetalae*. It is also the only species of section *Helmiopsis* in which the style lobes are erect and closely appressed, though much longer than those in section *Glandulipetalae*, and the only one with petioles mostly more than 1.5 cm long and leaves mostly 5-veined at the base. In addition, it is easily distinguished from the remainder of section *Helmiopsis* by its completely glabrous leaves.

4. *Helmiopsis hily* Arènes, Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 415. 1956. TYPE: Madagascar. Toliara: Betsipotika, Analaiava, Morondava [20°17'S, 044°27'E], 5 Apr. 1953 (fl.), *Service Forestier* 7226 (holotype, P!; isotype, TEF not seen).

Tree to 10 m high (to 20 m high and 0.5 m diam. in subspecies *boinensis*), or occasionally large shrub to 6 m high; twig bark dark grayish brown, shallowly ridged with small rounded pale lenticels; young twigs ferruginous, densely lepidote. Leaves borne directly on long twigs or singly or clustered on short shoots, narrowly lanceolate to lanceolate, (2.6–)3–7.3(–7.7) cm × (7–)9–16(–21) mm; petiole (1.5–)5–12(–13.5) mm, densely lepidote; basal veins 3, the lateral weak; base rounded; apex acute with rounded tip, occasionally rounded or emarginate; margins entire, often slightly irregular; adaxial surface glabrous, abaxial surface densely lepidote, pale or silvery green, usually with scattered tiny brown spots due to pigmentation of some large scales; midrib conspicuous, secondary venation pinnate, weak; stipules less than 1 mm, deltoid, lepidote, immediately caducous and very rarely present. Inflorescences lateral, geminate or occasionally a 3-flowered cyme or flowers solitary; peduncle (1–)2–11 mm; pedicels angular, articulated near bud, (4–)7–16 mm; bracteoles rapidly caducous; peduncles and pedicels lepidote; only 1 flower or all 2 to 3 flowers maturing to fruit. Sepals narrowly lanceolate, 7–9.2(–10) mm, lepidote, base of adaxial surface glandular-pubescent; petals creamy or yellow, (6.5–)8.5–13.5(–15) × (4.5–)5–7.5 mm, ovate, caducous; androecial corona 1.2–2 mm; fertile stamens normally 15; filaments 2–4.5(–5) mm; anthers linear, 2.1–3.8(–4.5) mm, often but not always clearly

oppositipetalous; staminodes spatulate, 2.5–3.2(–4) mm, oppositisealous or occasionally tending toward oppositipetalous; gynoecium 3(to 4)-carpellate; ovary lepidote, 3(to 4)-lobed; style lepidote for entire length, (3.2–)4–5.8(–6.8) mm; style lobes strongly recurved, 2–3 mm. Fruit a 3-valved, lepidote capsule, irregularly elliptical to broadly oblong-elliptical or ovate-elliptical, deeply 3-lobed, (7.5–)8–15.6 mm; seeds (where known) 1 per locule, ca. 3.6–3.8 mm, irregularly elliptical with a flattened ventral surface, with a tapering apical wing ca. 4.2–5.1 mm.

Distribution. *Helmiopsis hily* is native to forests in the arid southwestern portion of Madagascar and (subspecies *boinensis*) the northwestern Boina region.

IUCN Red List category. Each subspecies is assessed separately, below.

Common names. Hily (*Service Forestier* 7226, 9819); Pisopisonala (*Service Forestier* 3398, 4984); Andriambolafoty (*Service Forestier* 14294); Menahy (*Service Forestier* 15794).

Discussion. Almost all flowers, and all maturing fruits seen, are 3-carpellate; the presence of four ovary lobes and style branches (as reported by Arènes, 1959) appears to be an abnormal condition. Arènes (1956b, 1959) placed this species alone within *Helmiopsis* subg. *Phelmiosis* due to its reduced carpel number. This treatment is unwarranted, as the reduction in carpel number seems very likely to be not a plesiomorphic character within the genus, but an autapomorphy, which has no relevance to the question of relationships to other species; *H. hily* otherwise has for the most part typical features of section *Helmiopsis*.

KEY TO THE SUBSPECIES OF *HELMIOPSIS HILY* IN MADAGASCAR

- 1a. Tree to 10 m high or large shrub; leaves (7–)9–16 (–18) mm broad, mostly borne directly on twigs or clustered on short shoots; often only one flower per inflorescence maturing; pedicels (4–)7–10(–12) mm long; capsule (7.5–)8–10.6 mm long; native to southwestern Madagascar 4a. subspecies *hily*
- 1b. Tree to 20 m high; leaves to at least 21 mm broad, often borne singly on short shoots ca. 1 cm long; often all flowers (2 to 3) of inflorescence maturing; pedicels in fruit to 11–16 mm long; capsule 12–15.6 mm long; native to northwestern Madagascar 4b. subspecies *boinensis*

4a. *Helmiopsis hily* Arènes subsp. ***hily***.

Tree to 10 m high, or occasionally shrub to 6 m high. Leaves mostly borne directly on long twigs or clustered on short shoots, narrowly lanceolate to lanceolate, (2.6–)3–7.3(–7.7) cm × (7–)9–16(–18) mm; petiole (1.5–)5–12(–13.5) mm. Often only one flower per inflorescence maturing; peduncles (1–)3–

6(–11) mm; pedicels 4(–)7–10(–12) mm. Sepals narrowly lanceolate, 7–9.2(–10) mm, lepidote, base of adaxial surface glandular-pubescent; petals creamy or yellow, (6.5–)8.5–13.5(–15) $\times$ (4.5–)5–7.5 mm, obovate, caducous; androecial corona 1.2–2 mm; fertile stamens normally 15; filaments 2–4.5(–5) mm; anthers linear, 2.1–3.8(–4.5) mm, often but not always clearly oppositipetalous; staminodes spatulate, 2.5–3.2(–4) mm, oppositisepalous or occasionally tending toward oppositipetalous; gynoecium 3(to 4)-carpellate; ovary lepidote, 3(to 4)-lobed; style lepidote for entire length, (3.2–)4–5.8(–6.8) mm; style lobes strongly recurved, 2–3 mm. Fruit elliptical to oblong, (7.5–)8–10.6 mm, deeply 3-lobed; seeds 1 per locule, ca. 3.6–3.8 mm, irregularly elliptical with a flattened ventral surface, with a tapering apical wing ca. 4.2–5.1 mm.

Distribution, phenology, and habitat. *Helmiopsis hily* subsp. *hily* is native to southwestern Madagascar (Fig. 1). One collection was noted to be on sand at 600–850 m altitude. Flowering usually occurs from January to March (with one specimen flowering in October), as is typical in the arid southwest; immature fruit has been collected in March, and nearly mature fruit in May.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Least Concern (LC).

Specimens examined. MADAGASCAR. **Toliara:** forêt de Zombitsy [22°46'S, 044°42'E], forêt de l'Isalo, *Humbert et al.* 29604 (MO, P); forêt près de l'Isahaina, entre Sakaraha et Beroroha, *Service Forestier* 527 (MO, P [2]); Onidranovory, Tuléar, *Service Forestier* 3398 (P, TAN); Hazoroa, Sakaraha [23°00'S, 044°36'E], *Service Forestier* 4984 (P, TAN); Troboampamaky, Beharona, Manja [21°31'S, 044°19'E], *Service Forestier* 9819 (MO, P); forêt de Zombitsy [22°46'S, 044°42'E], *Service Forestier* 11908 (P [3]); Zombitsy [22°46'S, 044°42'E], *Service Forestier* 14294 (P, TAN); Betsako, Ankazoabo [22°21'S, 044°42'E], *Service Forestier* 15794 (P); haut bassin de la Sakoa (rt. Betioky–Bekily), *Service Forestier* 20704ter (P); forêt d'Analamamatahitse (Analamatahotra) entre Bekily et la rte. Beraketa–Antanimora, *Service Forestier* 22531 (MO [2], P).

4b. *Helmiopsis hily* Arènes subsp. *boinensis* Appelq., subsp. nov. TYPE: Madagascar. Mahajanga: forêt de Bekapika sur le plateau d'Antanimena (Boina) [16°28'S, 046°11'E], 12–14 Nov. 1957 (fr.), *Service Forestier* 18423 (holotype, P!). Figure 2.

Haec subspecies a *Helmiopse hily* Arènes subsp. *hily* statura majore, foliis leviter latioribus saepe singulatim ad ramunculos breves portatis, inflorescentiis leviter majoribus atque fructibus majoribus differt.

Tree to 20 m high; many leaves borne singly on short shoots ca. 1 cm long; leaves lanceolate, 3.8–6.4 cm $\times$ 12–21 mm; petioles 7–13.5 mm. Usually

both (or all three) fruits per inflorescence maturing; at maturity peduncles 2–11 mm, pedicels 11–16 mm. Flowers not known. Fruit broadly oblong-elliptical to ovate-elliptical, 12–15.6 mm; seeds not known.

Distribution, phenology, and habitat. The single known collection is from the northwestern Boina region of Madagascar (Fig. 1); mature fruits, with seeds already dispersed, were collected in November.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Data Deficient (DD).

Discussion. *Helmiopsis hily* subsp. *boinensis* can be distinguished from *H. hily* subsp. *hily* by its larger size (trees to at least 20 m), slightly broader leaves frequently borne singly on short shoots, larger inflorescences, and larger fruits. However, it resembles subspecies *hily* in other morphological characters; thus, lacking information on floral morphology or variation in vegetative morphology, the two are most conservatively treated as subspecies of a single species. A significant group of endemic species are confined to the area of northwestern Madagascar that includes the Boina region, e.g., *H. calcicola*, *Dombeya ankarafantsikae* Arènes and *D. boeniensis* Arènes (Arènes, 1958), *Perrierodendron boinense* (H. Perrier) Cavaco (Lowry et al., 2000), *Combretum boinensis* Jongkind (Jongkind, 1995), and *Dalbergia davidii* Bosser & R. Rabev. (Bosser & Rabevohitra, 1996), to name only a few. It would therefore be worth investigating the possibility that this disjunct and distinctive population actually represents another locally endemic species.

5. *Helmiopsis polyandra* Appelq., sp. nov. TYPE: Madagascar. Prov. Antsiranana: forêt d'Analafiana, au N de la basse Manambery (au SW de Vohémar [Iharana, 13°21'30"S, 050°00'30"E]), 11 Mar. 1967 (fl.), *Service Forestier* 27532 (holotype, P!; isotype, MO!). Figure 3.

Species nova quae a *Helmiopse boivinii* (Baill.) Arènes foliis infra pallidis, pedicellis brevioribus, bracteolis longioribus tarde delapsis, petalis minus quam 10 mm longis suborbicularibus, staminibus ca. 30 atque staminodiis oblongo-obovatis 2.7–3.1 mm longis differt.

Tree to 8 m high; twig bark reddish brown, shallowly ridged, with pale lenticels; young twigs pale, lepidote. Leaves oblong-elliptical to elliptical, lanceolate, or rarely ovate, (2.2–)3.2–6.5(–9.5) $\times$ (1.1–)1.4–2.5(–3.4) cm; petiole 4–10(–13) mm, densely lepidote; basal veins 3(to 5), the lateral weak; base rounded; apex rounded-acute or emarginate; margins entire to weakly undulate; abaxial surface lepidote, adaxial surface at maturity sparsely lepidote or glabrous, sometimes bearing few tiny unbranched hairs of crystalline appearance, distinctly different

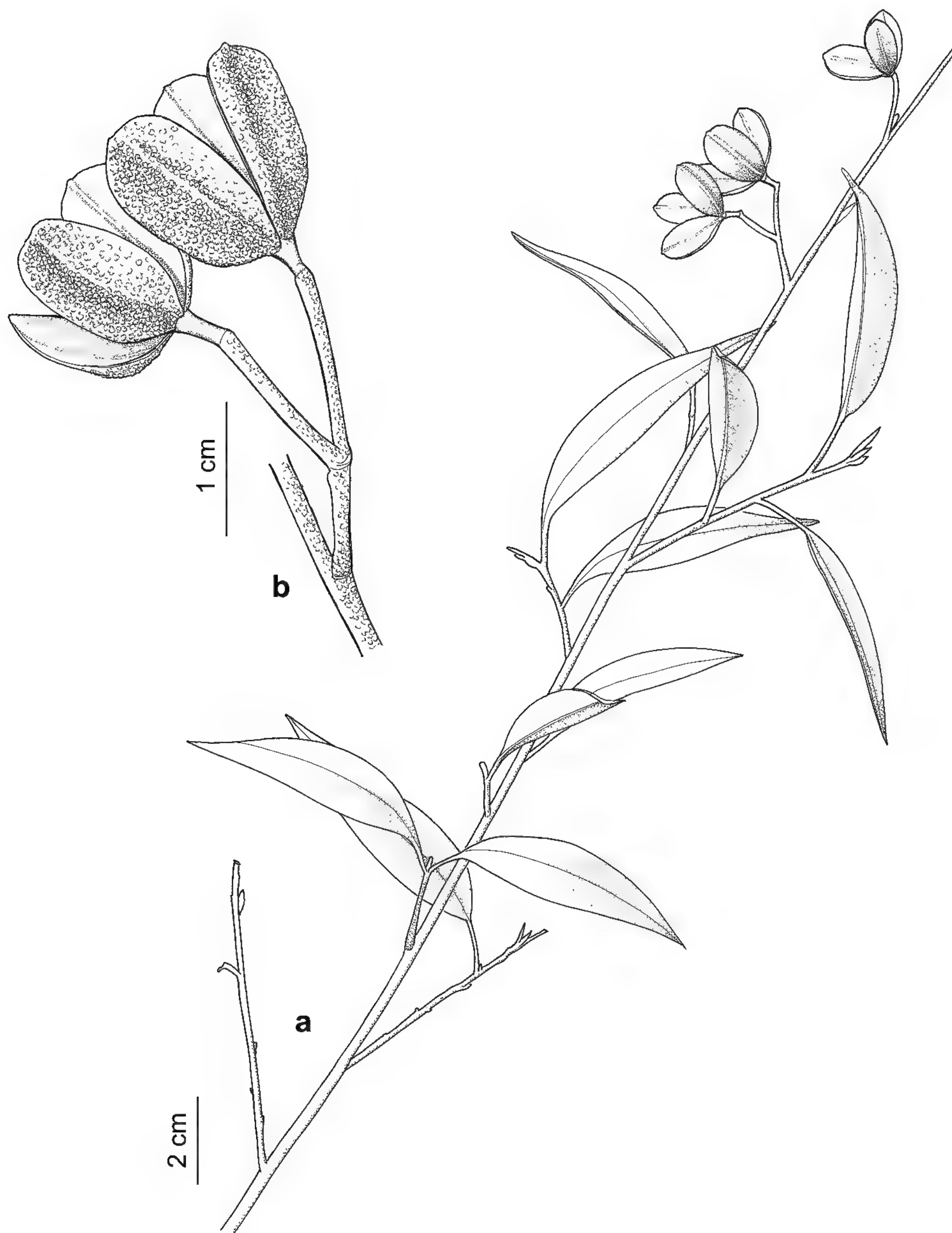


Figure 2. *Helmiopsis hily* Arènes subsp. *boinensis* Appleq. —A. Fruiting branch. —B. Old fruit. Based on the type, *Service Forestier* 18423.

from abaxial surface in color, usually with visible venation; stipules ca. 1.2–1.5 mm, lanceolate, lepidote, caducous and rarely present. Inflorescences geminate or 3- to 4-flowered cymes or flowers solitary, axillary; peduncles 2–6.5 mm; pedicels $\pm$ angular, articulated, 3–6 mm, in fruit woody to 10 mm; bracts few, ca. 2.6–3.5 mm, caducous; bracteoles inserted slightly beneath bud, ovate, 1.3–1.7(–2.4) mm, caducous but often persisting on smaller buds; inflorescences lepidote throughout. Sepals narrowly

lanceolate, 7.5–8.2 mm, lepidote, the basal portion of the adaxial surface glandular; petals 8.2–9.3 $\times$ 7.5–8.5 mm, suborbicular; androecial corona virtually absent; fertile stamens ca. 30, in groups of 6, oppositisealous; filaments 2–3.5 mm; anthers oblong, 2.3–3.1 mm; staminodes oblong-obovate, 2.7–3.1 mm; gynoecium 5-carpellate; ovary lepidote; style pale yellow, lepidote throughout, ca. 3 mm; style lobes erect with recurved apices, ca. 2.4–2.5 mm; ovule shortly winged. Mature capsule ca. 20 mm, roughly

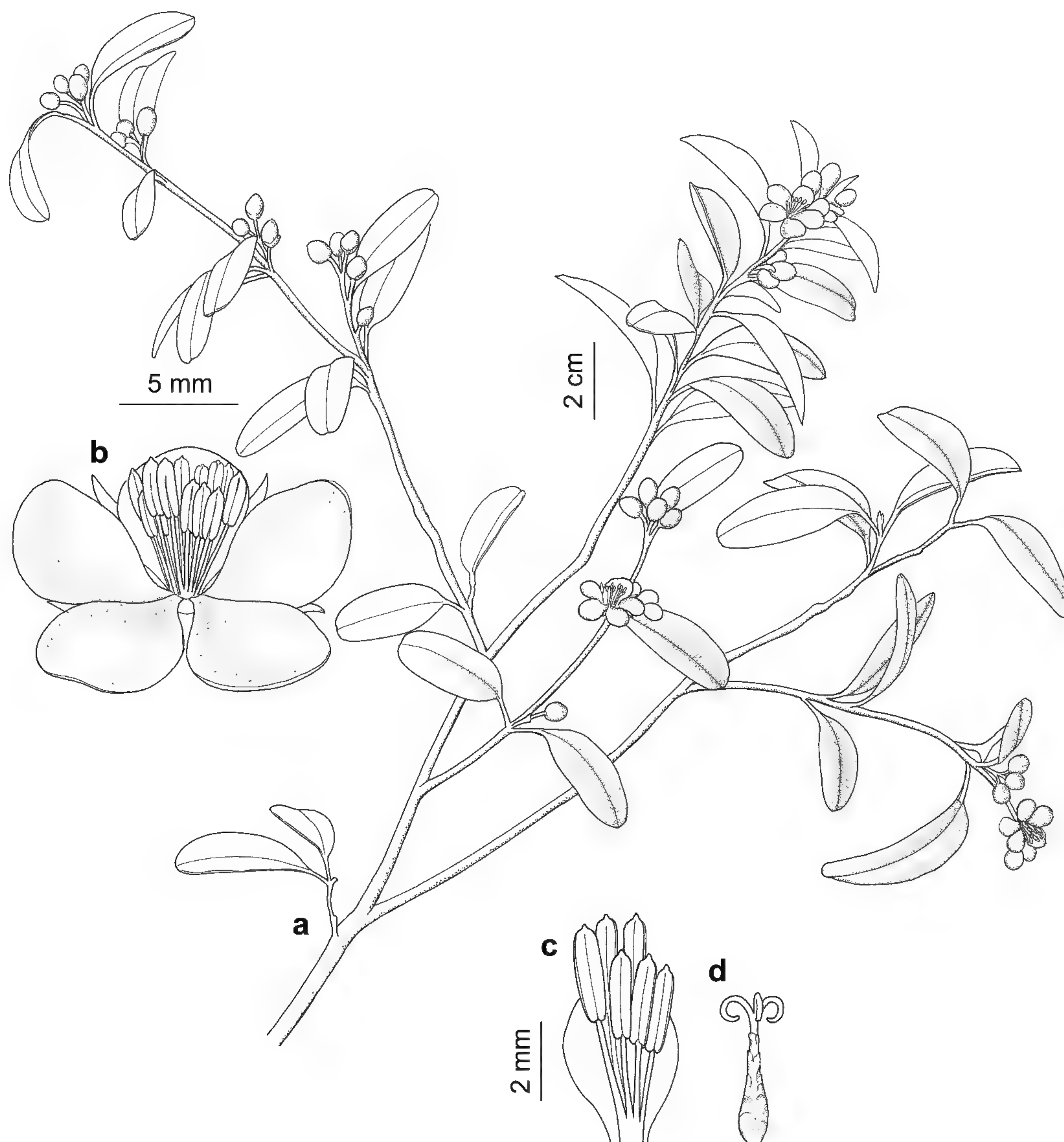


Figure 3. *Helmiopsis polyandra* Appleq. —A. Flowering branch. —B. Flower. —C. Cluster of stamens. —D. Gynoecium. Based on the type, *Service Forestier* 27532.

ovoid or cylindrical, grayish brown, with irregular surface, lepidote; seeds unknown.

Distribution, phenology, and habitat. This new species is known only from a few sites in the extreme northeast of Madagascar (Fig. 1); one collection is recorded from 300 m altitude. Buds and flowers have been collected in March; the only fruit seen, also collected in March, was old fruit that remained on the plant from the previous flowering period.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Vulnerable (VU D2).

Only three distinct populations have been collected; if area of occupancy were calculated using a 4 km² cell, as suggested by IUCN (2001), the range of this species would be only 12 km². It seems to be limited to a relatively small portion of Madagascar that, like much of the country, has suffered significant deforestation (e.g., Du Puy & Moat, 2003).

Discussion. Known specimens of this species have been previously identified as *Helmiopsis hily*, apparently due to their relatively narrow leaves and variable color differences between leaf surfaces. However, the

affinities of *H. polyandra* to *H. boivinii* seem much greater; for example, *H. hily* has strongly lobed ovaries and relatively few stamens. The former two species also share a geographic range in the extreme north, whereas *H. hily* is a southern and western species. *Helmiopsis boivinii* may be distinguished from *H. polyandra* by its frequently ovate leaves, whose abaxial surfaces are not so distinctly paler than the adaxial surfaces; its pedicels are (6–)8–16(–19) mm long, and its petals are (6–)10–13 mm long, obovate to obdeltoid rather than suborbicular. Additionally, *H. boivinii* has only (15 to)20 to 25 stamens, and the staminodes are spatulate and 2.8–4(–5) mm long; the bracteoles may be smaller (ca. 1 mm) and are more frequently lost even on very small buds.

Service Forestier 23078bis is a sterile specimen whose leaves, sparsely lepidote on both surfaces at maturity, are much larger than those of the three collections of *Helmiopsis polyandra* from closer to Iharana. As its appearance (including leaf shape, venation, bark, and stipule morphology) is generally consistent with that of the known specimens of *H. polyandra*, it is placed therein.

Paratypes. MADAGASCAR. **Antsiranana:** lisière supérieure de la forêt d'Andranomadiro [12°38'S, 049°28'E] (rebord S du plateau de Sahafary, entre les bassins de la Saharenana et du Rodo [Irodo]), *Service Forestier 23078bis* (P); forêt d'Analafiana, au N de la basse Manambery (au SW de Vohémar), *Service Forestier 27516* (MO, P); massif du Bezavona [13°32'S, 049°54'E] (entre la Fanambana et la Manambery), pentes inférieures de la rive droite de l'Andilana, *Service Forestier 27540* (MO, P).

II. *Helmiopsis* sect. *Glandulipetalae* Arènes, Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 416. 1956. TYPE: *Helmiopsis pseudopopulus* (Baill.) Capuron ex Arènes, designated here [$\equiv$ *Dombeya pseudopopulus* Baill.].

Trees, sometimes large, or large shrubs; twig bark grayish to dark reddish brown, shallowly ridged, with small pale lenticels; young twigs usually lepidote or bearing scurfy scales. Leaves broad, ovate to broadly elliptical, orbicular, or occasionally obovate; petiole lepidote; basal veins 5 to 7, well developed; base shallowly cordate to rounded-truncate or rounded; apex variable; margins entire to weakly repand, crenulate, or crenate-serrate; at least the abaxial surface lepidote; stipules small, lanceolate or scurfy, rapidly caducous. Inflorescences lateral and sometimes terminal, cymose with up to several orders of branching or geminate; bracts lanceolate, immediately caducous; bracteoles lanceolate, inserted immediately or well below bud, immediately caducous; pedicels $\pm$ angular, sometimes articulated; inflorescences lepidote throughout. Sepals lanceolate, lepidote, normally bearing small inconspicuous glandular patches at the very base of the adaxial

surface; petals white to creamy or yellowish, obovate, $\pm$ glandular on lower portion of adaxial surface; fused base of androecium coroniform; fertile stamens normally 10 (rarely 5 or 15 in aberrant flowers), borne in pairs, $\pm$ oppositipetalous; filaments short, anthers linear; staminodes spatulate, longer than fertile stamens; gynoecium 5-carpellate; ovary lepidote, often 5-lobed; style lepidote basally to throughout; style lobes erect, clustered. Inflorescence branches usually lengthening and becoming woody in fruit; fruit a capsule, ovoid or subspherical, often 5-lobed; seeds (1 to)2 per locule, only 1 well developed, with a prominent apical wing or unwinged in 1 species.

Distribution. *Helmiopsis* sect. *Glandulipetalae* is confined to forested areas in the extreme north of Madagascar (Fig. 4). A variety of substrate types are reported.

Discussion. Arènes (1956b, 1959) did not specify a type species for this section. *Helmiopsis pseudopopulus* is therefore selected herein as type for section *Glandulipetalae*.

KEY TO THE SPECIES OF *HELMIOPSIS* SECT. *GLANDULIPETALAE* IN MADAGASCAR

- 1a. Leaves transversely elliptical, breadth well exceeding length; inflorescences geminate or cymose with up to 6 (rarely to 12) buds; petals 15–26 mm long; capsule ca. 18–23 mm long 6. *H. bernieri*
- 1b. Leaves broadly ovate to orbicular, occasionally elliptical, obovate, or depressed-ovate; inflorescences repeatedly branched cymes; petals less than 15 mm long; capsule not over 18 mm long.
 - 2a. Leaves broadly ovate to orbicular; basal veins 5; apex acuminate; margins entire to shallowly repand or rarely crenulate; petals (7–)11–13 (–15) mm long, basal adaxial surface usually sparsely to moderately glandular; ovary and fruit not strongly lobed 8. *H. richardii*
 - 2b. Leaves variable in shape; basal veins 5 to 7; margins crenulate to shallowly repand or crenate-serrate; petals 7–11.5 mm long, basal adaxial surface densely glandular; ovary and fruit strongly 5-lobed.
 - 3a. Leaf margins weakly crenate to repand; basal veins (5 to)7; venation not prominently raised; style lepidote only beneath; ovules and seeds winged 7. *H. pseudopopulus*
 - 3b. Leaf margins crenate-serrate; basal veins 5 to 7; venation prominently raised; style sometimes lepidote throughout; ovules and seeds not winged 9. *H. sphaerocarpa*

6. *Helmiopsis bernieri* (Baill.) Arènes, Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 416. 1956. Basionym: *Dombeya bernieri* Baill., Bull. Mens. Soc. Linn. Paris 1: 500–501. 1885. TYPE: Madagascar. Lingvatu [12°26'S, 049°30'E], (fl.), *J. Bernier* (2^{me} envoi) 338 (holotype, P!; isotypes, BM not seen, G not seen, P!).

Small tree, to 7–8 m high, or large shrub; twig bark grayish, shallowly ridged, with small pale lenticels; young twigs ferruginous, densely lepidote. Leaves transversely elliptical to barely reniform, (2–)2.5–5.5(–7) × (2.2–)3.5–8(–11) cm, coriaceous; petiole (1–)1.5–3(–4.8) cm, densely lepidote; basal veins 5; base rounded-truncate to broadly rounded or very shallowly cordate; apex rounded, occasionally short-acuminate; margins entire to weakly repand; both surfaces lepidote, densely so in young leaves, with scales of variable size and coloration; stipules ca. 1.5–3 mm, scaly to lanceolate, usually immediately caducous. Inflorescences few-flowered, geminate or with up to 6(to 12) buds, mostly clustered at twig apices on short thick peduncles (usually 1–1.5 cm), sometimes subtended by small leaves, or individual lateral inflorescences borne on peduncles to 5(–8.5) cm; only 1 flower per inflorescence maturing at a time; bracts lanceolate, (3.2–)4.4–6.3 mm, rapidly caducous; bracteoles lanceolate, keeled, (3.5–)4.2–5.5(–6.8) mm, inserted just below bud, rapidly caducous; pedicels thick, ± angular, articulated, 2–6(–9) mm; inflorescences lepidote throughout. Sepals narrowly lanceolate, 14–17 mm, lepidote, reflexed at maturity, bearing small patches of glandular tissue at base of adaxial surface; petals whitish with a creamy or pale yellowish tinge, (15–)19–24(–26) × (13–)19–26(–29) mm, broadly obovate and often broader than long, adaxial surface basally glandular; androecial corona 1–2 mm; fertile stamens 10, oppositipetalous in pairs; filaments (1.5–)2–2.5 mm; anthers linear, 4–5.8(–6.4) mm; staminodes spatulate, 8–11 mm, oppositisepalous; gynoecium 5-carpellate; ovary lepidote, weakly 5-sided; style lepidote, 4.5–5(–5.8) mm; style lobes erect, clustered, (1–)1.5–2.3 mm; ovules up to 6 per locule. Inflorescence becoming woody in fruit; fruit a woody capsule, ovoid, ca. 18–23 mm, shallowly 5-lobed with a short apical nipple, lepidote; young seeds with a long apical wing, mature seeds not known.

Distribution, phenology, and habitat. *Helmiopsis bernieri* is confined to a very small region of extreme northern Madagascar in the vicinity of Antsiranana (Diégo-Suarez; Fig. 4) and grows on sand in sometimes degraded forested areas. Flowering is recorded from November through March; the only fruiting collection known was made in November.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Vulnerable (VU D2). No more than five clearly distinct locations and two distinct populations are known; all collections of *Helmiopsis bernieri* have been from a limited range, such that a single natural disaster could affect all populations simultaneously, and most of the forest remaining in these areas is not formally protected.

Discussion. *Helmiopsis bernieri* is a very distinctive species, easily distinguished by its transverse-elliptical leaf shape; it also has the largest flowers and fruits in the genus.

Specimens examined. MADAGASCAR. **Antsiranana:** Baie de Rigny [12°26'S, 049°32'E], *Bernier 2603* (P); S of Pic Raynaud, S rte. de la Baie de Rigny, *Service Forestier 20361* (MO [2], P); forêt d'Orangea [12°15'S, 049°23'30"E], *Service Forestier 20937* (MO, P); Diégo-Suarez, près d'Antsoha, piste d'Androfiabe à la baie de Rigny, *Service Forestier 23039* (MO [2], P); forêt d'Orangea [12°15'S, 049°23'30"E], *Service Forestier 23274* (MO, P).

7. *Helmiopsis pseudopopulus* (Baill.) Capuron ex Arènes, as “*Pseudo-Populus*,” Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 416. 1956. Basionym: *Dombeya pseudopopulus* Baill., as “*pseudo-Populus*,” Bull. Mens. Soc. Linn. Paris 1: 500. 1885. TYPE: Madagascar. Prov. Antsiranana: Lingvaton [12°26'S, 049°30'E], s.d. (fl.), *J. Bernier (2e envoi) 339* (holotype, P!; isotypes, G not seen, P!).

Tree to 10(–20) m high, to 20 cm diam., or large shrub to 6 m high; twig bark grayish to reddish brown, shallowly ridged, with small pale lenticels; young twigs pale, lepidote. Leaves broadly ovate to orbicular, sometimes depressed-ovate, 3.2–10.5 × 4–10 cm; petiole 2.7–7.5(–10.5) cm, densely lepidote, slightly reddish; basal veins 7 or rarely 5; base cordate or occasionally rounded-truncate; apex acuminate to acute, cuspidate, or occasionally rounded; margins shallowly crenate to shallowly repand; both surfaces lepidote, often sparsely so on larger leaves, the abaxial surface slightly grayish green with pale nerves, the adaxial surface slightly yellowish; stipules lanceolate to linear, 2–6 mm, immediately caducous and almost never present. Inflorescences cymose with few orders of branching, axillary and sometimes terminal or pseudoterminal, clustered near distal ends of branches; peduncle (2.4–)3.5–6.5(–8.8) cm, inflorescences in total (4.2–)7–13(–14.6) cm; bracts immediately caducous; pedicels 5–9 mm, ± angular, articulated; bracteoles inserted well below flower, immediately caducous; inflorescences and pedicels lepidote. Sepals lanceolate, 5–7 mm, lepidote, reflexed at maturity, yellowish, bearing small glandular patches inside at base; petals creamy or white, (7–)8.5–11.5 × (4.5–)5–8 mm, broadly obovate, lower portion of adaxial surface usually densely glandular; androecial corona 1.1–2 mm; fertile stamens 10 (rarely 15 in aberrant flowers), borne in pairs, usually ± oppositipetalous; filaments (0.6–)1.5–2 mm, fused for at least half their length; anthers linear, 1.6–2.4(–2.7) mm, orange; staminodes spatulate, 3.9–4.8 mm, usually oppositisepalous, at least sometimes yellow at the apex; gynoecium 5-carpellate; ovary lepidote, 5-

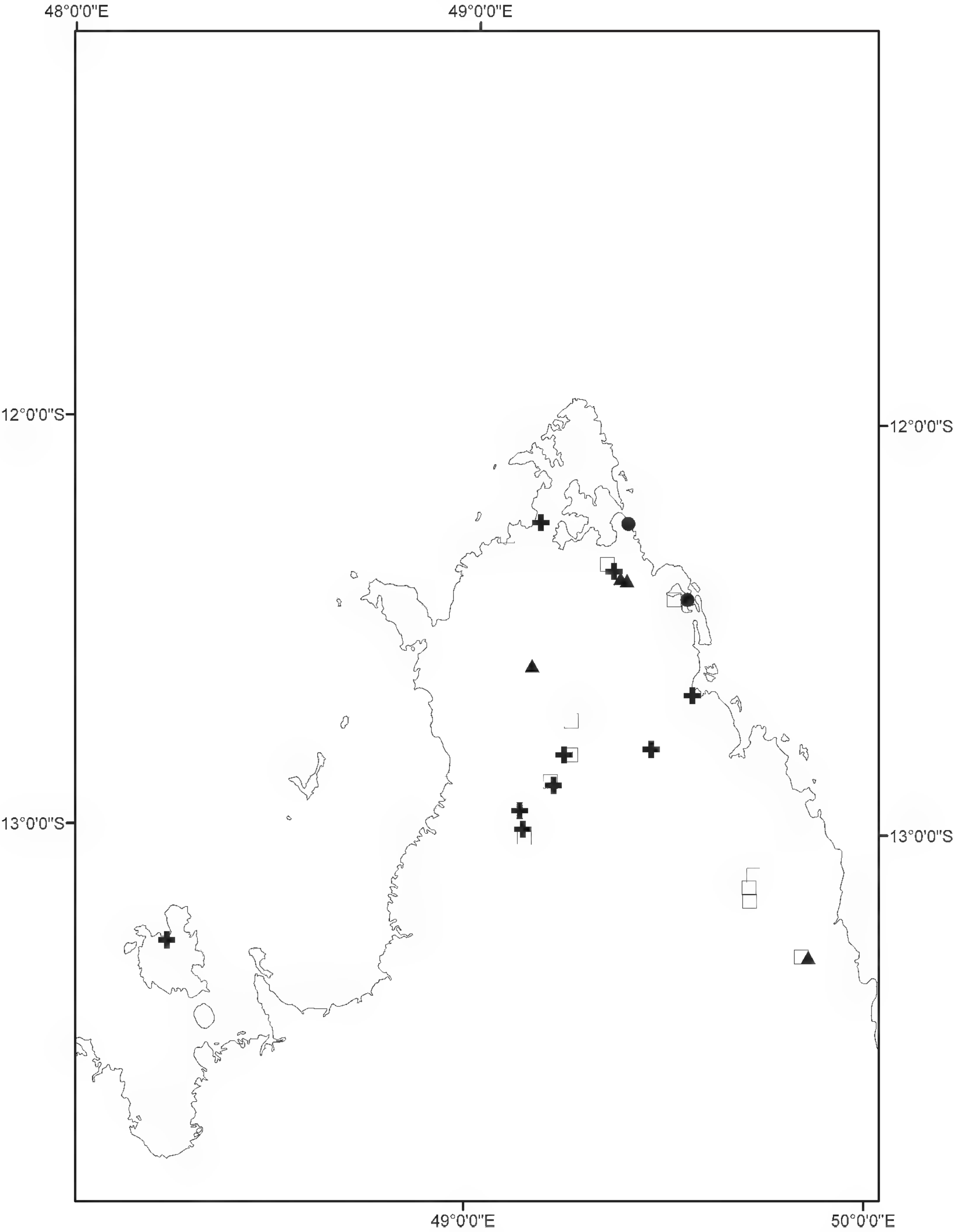


Figure 4. Approximate distribution of species of *Helmiopsis* sect. *Glandulipetalae* in northern Madagascar (● — *H. bernieri*; □ — *H. pseudopopulus*; + — *H. richardii*; ▲ — *H. sphaerocarpa*).

lobed; style lepidote on basal third to half, 3.5–5 mm, white; style lobes erect, clustered, 0.5–1.5 mm, orange. Inflorescence branches lengthening and becoming woody in fruit; capsule ovoid and deeply

5-lobed, (9–)12–18 mm, immature fruit golden greenish (tan when dried, possibly darkening with age), lepidote, persistent sepals often present; apex acute, sometimes beaked or rounded; inner surfaces of

locules glabrous; seeds 2 per locule, only 1 well-developed, at maturity ca. (3–)4.5–6 mm, with 6–8 mm apical wing.

Distribution, phenology, and habitat. *Helmiopsis pseudopopulus* is native to a limited region of northern Madagascar (Fig. 4). Its collected habitat is forest, including gallery forest; one collection is at the shore. Altitude ranges to at least 300 m, and possibly as high as 450 m. No strong substrate preference is clear; collections have been made on limestone, on basalt, and at a locality with substrate including sand and rocks. Most flowering specimens are recorded from January to April (two November-flowering specimens have been collected from Montagne des Français); undehiscent fruits have been collected from March to May, and mature fruit with seeds still present in August. Flowers have been noted to have a *Malus*-like scent (Nusbaumer & Ranirison 1177).

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Least Concern (LC).

Common names. Hafomena (*Service Forestier* 9389).

Nomenclature and orthography. The orthography of the specific epithet of *Helmiopsis pseudopopulus* must be corrected to remove the hyphen, according to Article 60.9 of the ICBN (McNeill et al., 2006: cf. Ex. 20). This combination was first made by Capuron in Vol. 14, Fascicle 4 of *Notulae Systematicae* (Paris), which was dated on the front cover “Décembre 1952” (and which was received in libraries early enough in 1953 to indicate there was no lengthy delay in publication). However, the back cover gives 1953 as the publication date, and this is believed to be the more accurate source of information. Unfortunately, Article 33.4 of the ICBN (McNeill et al., 2006) required that new combinations published after 1 January 1953 provide a full and direct reference to the basionym’s place of publication. Capuron’s combination was therefore not validly published; it was validated by Arènes (1956).

Representative specimens examined. MADAGASCAR. **Antsiranana:** Ambilobe, massif de l’Ankarana, Ambilomangodro partie E, savane de bordure, 13°01’20”S, 049°08’14”E, *Bardot-Vaucoulon et al.* 1366 (MO, TAN); Daraina, sous-préfecture de Vohémar, forêt de Bekaraoka, partie sud, en aval d’Andranotsimaty, en direction du point coté 112, 13°09’59”S, 049°42’07”E, *Gautier et al.* 4383 (MO); pentes du Lac Sacre [– Antanavo] près Anivorano-Nord [12°44’S, 049°15’E], *Humbert* 32322 (MO, P); Montagne des Français [12°22’S, 049°21’E], *Keraudren* 1672 (MO, P); Mantamena, part of Bekaroaka Range, 7 km NE Daraina (Vohémar), 13°08’S, 049°42’E, *Meyers & Boltz* 167 (MO, TAN); sous-préfecture de Vohémar, commune rurale de Daraina, forêt de Bekaraoka, partie N, 13°06’11”S, 049°42’39”E, pente 22°, orientation 330°, bas de pente,

Nusbaumer & Ranirison 1177 (MO); Ankara, Diégo-Suarez, *Service Forestier* 5438 (MO, P, TAN); Ankara, Diégo-Suarez, *Service Forestier* 9389 (P); Montagne des Français, vallée de la’Andavakoera, *Service Forestier* 20922 (MO, P); Montagne des Français, Pic des Orchidées, *Service Forestier* 23250 (MO, P); en bordure de mer, près d’Ankingameloka (baie d’Ambararata, Diégo-Suarez) [12°17’S, 049°05’E], *Service Forestier* 24661 (MO, P); près de Marotaolana (Anivorano-Nord) [12°49’S, 049°15’E], *Service Forestier* 24717 (P); calcaires lapiazés de l’Ankarana, près d’Ambondromifehy [12°53’S, 049°12’E], *Service Forestier* 24730 (MO, P); versant E du massif de l’Ankerana (partie S du massif de Mafokovo [ca. 13°18’S, 049°50’E], au N de Vohémar, *Service Forestier* 27412 (MO [2], P).

8. *Helmiopsis richardii* (Baill.) Capuron ex Arènes, Bull. Mus. Natl. Hist. Nat., sér. 2, 28: 416. 1956. Basionym: *Trochetia richardii* Baill., as “*Richardi*,” *Adansonia* 10: 108. 1871. *Dombeya richardii* (Baill.) Baill., as “*Richardi*,” Bull. Mens. Soc. Linn. Paris 1: 500. 1885. TYPE: Madagascar. Prov. Antsiranana: Nossi-Bé [Nosy Be 13°17’S, 048°15’E], (fl.), *J. M. C. Richard* 343 (holotype, P!; isotype, P!).

Tree to 15 m high, at least 20 cm DBH; twig bark grayish to reddish brown, shallowly ridged, with small pale lenticels; young twigs pale, lepidote. Leaves broadly ovate to orbicular, (3–)4.2–8.7(–11.3) × 3.1–8.4(–10.8) cm, thick-textured; petiole (1.7–)3–6.8(–8.3) cm, densely lepidote; basal veins 5; base shallowly cordate to rounded-truncate or rounded; apex acuminate; margins entire to weakly repand or very rarely shallowly crenate; both surfaces lepidote, the abaxial surface pale green; stipules ca. 2–2.5 mm, lepidote and sometimes possibly dark-margined, immediately caducous. Inflorescences cymose with few orders of branching, lateral, clustered at distal ends of twigs; peduncle 2.5–5(–7.5) cm; branches of inflorescence compact, inflorescences in total 5.5–12 cm; bracts immediately caducous; pedicels (3–)9–15(–20) mm, ± angular, articulated; bracteoles inserted well below flower, immediately caducous; inflorescences and pedicels lepidote. Sepals narrowly lanceolate, (4–)6.5–10.4 mm, lepidote, yellow-green with brownish scales, reflexed at maturity, usually bearing small glandular patches inside at base; petals white to creamy or greenish white or pale yellow, (7–)11–13(–15) × (5–)6–8(–10) mm, broadly obovate, lower portion of adaxial surface sparsely to moderately glandular or subglabrous; androecial corona 1.2–1.9(–2.4) mm; fertile stamens (5 to)10, borne in pairs or rarely singly, usually ± oppositipetalous; filaments (1–)1.5–2 mm, fused for half their length, white; anthers linear, (1.6–)2.4–4(–4.3) mm, brown; staminodes spatulate, (4.5–)5–8.5 mm, usually oppositispalous; gynoecium 5-carpellate; ovary lepidote; style lepidote on basal portion to lower third, 4.2–6(–7.5)

mm; style lobes erect, clustered, 1–1.8 mm. Inflorescence branches lengthening and becoming woody in fruit; capsule ovoid, (7–)11–18 mm, tapering or shorter and truncate with or without a small beak, internally glabrous, dehiscing from the apex, reddish brown, lepidote; seeds 2 per locule, only 1 well developed, in larger fruits ca. 4.5–5 mm with 7–8 mm apical wing, in small fruits ca. 3–4 mm with wing ca. 3–5.4 mm.

Distribution, phenology, and habitat. *Helmiopsis richardii* is native to a limited region of northern Madagascar (Fig. 4). Its collected habitat is forest on a variety of soil types, but especially on calcareous substrates, sometimes near rivers. The reported altitude range is from 90 to at least 200 (possibly to 350) m. The recorded flowering period is (November to) February to April; mature fruits with seeds have been collected in April (Ankarana), July (Montagne des Français), and October (Baie de Diégo-Suarez). Flowers have been reported to smell slightly of fish (Cheek et al. B1408).

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Least Concern (LC).

Common names. Miriky (Service Forestier 9432); Selimavo (Service Forestier 15061); Sely (Service Forestier 14883).

Discussion. This species bears considerable general resemblance to *Helmiopsis pseudopopulus*, but can be distinguished by its unlobed ovary and fruit and by its more sparsely glandular petals; the basal portion of the petals of *H. pseudopopulus* bears a fairly dense and even coating of small glands, except where these have been lost to disturbance, whereas those of *H. richardii* have relatively few, unevenly distributed glands. On average, *H. richardii* has slightly larger flowers, with larger sepals, petals, and androecial parts (sepals mostly over 7 mm, anthers mostly over 2.4 mm, staminodes mostly over 5 mm) and longer pedicels (usually over 9 mm). Unfortunately, the type of *H. richardii* represents the smallest extreme of that species' floral size range, perhaps because it is from a geographically and genetically distinct population (the island of Nosy Be), although the specimen is not in ideal condition. Little fruiting material referable to *H. richardii* is known, but it encompasses fruits with two distinct morphologies. Fruits collected at Baie de Diégo-Suarez and Ankarana have a blunt apex with a short acute tip, while fruits from Montagne des Français are longer and have a tapering apex. More collection is certainly desirable.

Leaves of *Helmiopsis pseudopopulus* have shallowly crenate to undulate margins and apices that may range from acuminate to acute, cuspidate, or rounded. The

breadth of the leaves in *H. pseudopopulus* not infrequently exceeds the length, which is very rare in *H. richardii*; the basal veins almost always number seven, rarely five. Leaves of *H. richardii* are entire to shallowly undulate, but usually not shallowly crenate, relatively narrower and sometimes more graceful in appearance, with consistently acuminate apices; there are normally five basal veins. There is enough overlap in leaf morphology that sterile specimens may be very difficult to identify; the variation in basal leaf vein number may be the most useful character.

Two specimens from Ankarana have particularly unusual morphology: *Humbert 32551* (MO [2]) has typical *Helmiopsis richardii* floral morphology but prominently crenate-serrate leaves (with only five basal veins), while *Service Forestier 29220* (MO) has unlobed, narrowly elongated young fruits but slightly crenate leaves (with five to nine basal veins) and very small flowers on short pedicels (to 3 mm vs. a minimum of 6 mm in other collections). Typical *H. richardii* and *H. pseudopopulus* have both been collected from the Ankarana region, and the two species are clearly closely related. Hybridization between them may be possible and may account for these two intermediate specimens.

Nomenclature and orthography. As for *Helmiopsis pseudopopulus*, discussed above, the combination *H. richardii* was first made by Capuron (1952); an unfortunately timed publication delay rendered both combinations invalid under Article 33.4 of the ICBN (McNeill et al., 2006). The combination was validated by Arènes (1956), who simultaneously introduced the correct spelling of the epithet, the originally published Latin termination ("richardi") being an error requiring correction under Article 60.11 of the ICBN (McNeill et al., 2006).

Representative specimens examined. MADAGASCAR. **Antsiranana:** S of Anivorano Nord, env. Ambalabao, ca. 12°48'S, 049°14'E, Cheek et al. B1408 (TAN); Ankarana Special Reserve, ca. 5 km NW of Park Village near Besaboba stream, 12°57'16"S, 049°07'30"E, Harder et al. 1725 (MO); collines et plateaux calcaires de l'Analamera, *Humbert 19244* (P); plateaux calcaires de l'Ankarana du N entre Ambilobe et Anivorano, *Humbert & Capuron 25558* (P); environ de Diégo-Suarez, Montagne des Français [12°22'S, 049°21'E], *Keraudren 1646* (MO, P); Nosy Be [13°17'S, 048°15'E], *Richard 317* (P); plateau calcaire de l'Ankarana, au NE d'Ambondromifehy [12°53'30"S, 049°12'30"E], *Service Forestier 3040bis* (P); Antafiamatso-Diégo [12°40'S, 049°33'E], *Service Forestier 9432* (P); Baie Diégo-Suarez, *Service Forestier 14883* (P); Montagne des Français, Diégo-Suarez [12°22'S, 049°21'E], *Service Forestier 15061* (MO, P); plateau calcaire de l'Ankarana, à l'W d'Ambondromifehy (J.B. 8) [12°53'S, 049°12'E], *Service Forestier 22694* (MO, P); plateau de l'Ankarana, rebord S du Plateau de Mahory (rive gauche du haut Rodo) [12°49'S, 049°14'E], *Service Forestier 23144* (P); massif de l'Ambongoabo, entre la baie de

Diégo et celle du Courrier [12°15'S, 049°10'E], *Service Forestier* 24644 (MO [2], P).

9. *Helmiopsis sphaerocarpa* L. C. Barnett, Ann. Missouri Bot. Gard. 74: 450. 1987. TYPE: Madagascar. Prov. Antsiranana: massif de la Montagne d'Ambre [ca. 12°36'S, 049°09'E], crête entre les bassins de la rivière des Makis et de la rivière d'Ankazobe, 600–800 m, 26–27 May 1970 (fl.), *Service Forestier* 29194 (holotype, P!; isotypes, K not seen, MO!, P [2]!, TEF not seen).

Tree to at least 14 m high, 11 cm diam., or large shrub; twigs sturdy; bark fibrous, dark, somewhat reddish brown, shallowly ridged, with small pale lenticels; youngest twigs sometimes lepidote, with small scurfy fimbriate scales. Leaves broadly ovate to ovate or elliptical, or occasionally obovate or suborbicular, 5–13 × 3.5–9 cm; petiole (0.8–)2–5 (–7.8) cm, sparsely lepidote; basal veins 5 to 7; base shallowly cordate or occasionally rounded; apex acute to short-acuminate or rounded; margins crenate to crenate-serrate; adaxial surface glabrous or nearly so, abaxial surface sparsely lepidote, mostly along veins; venation conspicuous on both surfaces, prominent abaxially; stipules lanceolate, ca. 4–5 mm, rapidly caducous. Inflorescences cymose with several orders of branching, terminal and lateral, clustered near branch ends; peduncles 2–8 cm, inflorescences in total 6.5–15 cm, with lower internal branches well developed; bracts narrowly lanceolate, rapidly caducous; pedicels 2.5–6(–8) mm, ± angular; bracteoles inserted immediately below flower, rapidly caducous; inflorescences and pedicels lepidote. Sepals lanceolate, 5.2–6.5 mm, lepidote, yellowish, usually bearing small glandular patches inside at base; petals white, 7–10 × 6–8.5 mm, broadly obovate with asymmetrical apex, lower third of adaxial surface densely glandular; androecial corona 0.6–1.3 mm; fertile stamens 10, borne in pairs, ± oppositipetalous; filaments 0.7–2.2 mm, free to corona; anthers linear, 1.7–2.6 mm; staminodes spatulate, 5–5.8 mm, white, ± oppositisepalous; gynoecium 5-carpellate; ovary lepidote, 5-lobed; style lepidote basally or for entire length, 3.5–5.5 mm, whitish yellow; stigma lobes erect, clustered, ca. 0.5–0.8 mm. Inflorescence branches becoming woody in fruit; capsule subspherical, 5-lobed, 5.4–7 mm, dark brown, lepidote; apex rounded-truncate with small apical projection; fruit subtended by hardened persistent sepals; inner surfaces of locules glabrous; seeds 1 to 2 per locule, only 1 well developed, at maturity ca. 5–6 mm, irregularly rounded-triangular, ± laterally compressed, wingless except for inconspicuous keel.

Distribution, phenology, and habitat. *Helmiopsis sphaerocarpa* is native to a limited range of sites in

northern Madagascar (Fig. 4). The few known collections are from mountainous areas, one noted to be in dry deciduous forest, and the preferred habitat is probably rocky; reported altitudes range from 233 m to 600–800 m. Flowers have been collected in May and June, with mature fruits with seeds still present in September and December.

IUCN Red List category. Provisional IUCN Red List category (2001) is noted as Vulnerable (VU D2). Fewer than five locations are known. Other species of *Helmiopsis* from the same region have been more widely and frequently collected, suggesting that this species is relatively rare.

Common names. Selivato (*Service Forestier* 5673); Sely (*Rakotondrafara et al.* 268).

Discussion. Barnett (1987), in the original publication of *Helmiopsis sphaerocarpa*, suggested that this species is likely the sister taxon of *H. pseudopopulus*, with which it shares a number of vegetative, inflorescence, and floral characters or tendencies. The two can be distinguished in the vegetative state, as the leaves of *H. sphaerocarpa* are coarser in appearance, more conspicuously crenate, and closer to glabrous. The midrib and secondary veins are prominently raised on the abaxial surface for virtually their entire length and often conspicuously paler or darker than the leaf surface, whereas in *H. pseudopopulus* the secondary veins are weaker, often scarcely raised toward the distal ends, and not strongly colored. The fruit of *H. pseudopopulus* is larger (usually 12–18 mm long) and the seeds have a substantial apical wing, which is not present in *H. sphaerocarpa*. The sepals of *H. pseudopopulus* often persist during fruit maturation but never become as thick and woody as those of *H. sphaerocarpa*. Several small differences in floral morphology also separate the two species; for example, the filaments of stamen pairs in *H. pseudopopulus* are fused near the base, and the style is lepidote only on the lower portion.

Specimens examined. MADAGASCAR. **Antsiranana:** Sous-préfecture Antsiranana II, Commune Mahavanona, Fokontany Andranomanitra, Ampitiliantsambo, 15 km NE d'Andranomanitra, 12°23'18"S, 049°22'57"E, *Rakotondrafara et al.* 268 (MO); Diégo-Suarez, Montagne des Français [12°22'S, 049°21'E], *Service Forestier* 5673 (P); versant E du massif de l'Ankerana (partie S du massif de Mafokovo [ca. 13°18'S, 049°50'E]) au N de Vohémar, *Service Forestier* 27349 (MO, P).

SPECIMINA INCERTAE SEDIS

Helmiopsis sp. indet.: Madagascar. Prov. Antsiranana: forêt d'Analamahitsy (PK. 84 de la rte. Diégo–Ambilobe), entre Anivorano et Ambondromifehy

[12°48'S, 049°14'E], 22 Apr. 1963, *Service Forestier* 22669 (MO [2], P).

This collection, a white-flowered tree 15–18 m high, has been previously determined as *Helmiopsis pseudopopulus*; it has also been determined twice as “*H. angulata*,” a name used first by Capuron in sched. but apparently never published by him or any succeeding author. The general appearance is consistent with *H. pseudopopulus*, except that the inflorescences are unusually long (to 18 cm in flower). However, the petals are narrower (4–5 mm broad, with the breadth being less than half the length); the petal glands are very sparse rather than plentiful; the style is longer than usual (5.5–6.2 mm), bent or kinked below the stigmas, and lepidote for over half its length; and the staminodes are somewhat longer than usual (4.7–5.7 mm). This collection may well represent a distinct—and undoubtedly rare and endangered—species; however, since its locality is within the range of *H. pseudopopulus*, the possibility that it is a very unusual individual or distinct variety of that species cannot be ruled out. Further investigation and collection of populations along Route Nationale 6 would be highly desirable.

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